

Additional file for “A Novel Method for Expediting the Development of Patient Reported Outcome Measures and an Evaluation of Its Performance via Simulation” by Lili Garrard, Larry

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Table 1. Percent of CFA simulation iterations that fail to converge and/or produce out of bound item-to-domain correlation (i.e., $\rho_j \notin [-1, 1]$).

Number of Items (P)	Number of Participants (N)	Number of Response Categories (C)	CFA Fail to Converge (%)	CFA Out of Bound Estimate (%)
4	50	2	6	21
	50	5	1	13
	50	7	0	14
	100	2	3	14
	100	5	0	3
	100	7	1	4
	200	2	2	5
	200	5	0	1
	200	7	0	1
	500	2	0	1
	500	5	0	0
	500	7	0	0
6	50	2	2	21
	50	5	0	2
	50	7	0	2
	100	2	0	3
	100	5	0	0
	100	7	0	1
	200	2	0	2
	200	5	0	0
	200	7	0	0
	500	2	0	0
	500	5	0	0
	500	7	0	0
9	50	2	0	6
	50	5	0	0
	50	7	0	0
	100	2	0	0
	100	5	0	0
	100	7	0	0
	200	2	0	0
	200	5	0	0
	200	7	0	0
	500	2	0	0
	500	5	0	0
	500	7	0	0

Table 2. Item-to-domain correlation ρ estimates and standard errors for prior (content experts), OBID posterior informative (experts information used), and OBID posterior non-informative (experts information not used).

Item	Expert Prior	Hispanic ($N=36$)		African American ($N=34$)	
		OBID (Posterior Informative)	OBID (Posterior Non-informative)	OBID (Posterior Informative)	OBID (Posterior Non-informative)
Item 1	0.381 (0.130)	0.466 (0.093)	0.710 (0.123)	0.495 (0.086)	0.774 (0.102)
Item 2	0.673 (0.112)	0.565 (0.118)	0.570 (0.160)	0.674 (0.088)	0.791 (0.094)
Item 3	0.472 (0.119)	0.615 (0.074)	0.914 (0.055)	0.653 (0.066)	0.942 (0.036)
Item 4	0.629 (0.109)	0.717 (0.070)	0.920 (0.053)	0.718 (0.068)	0.884 (0.059)
Item 5	0.528 (0.116)	0.537 (0.097)	0.607 (0.159)	0.641 (0.074)	0.908 (0.056)
Item 6	0.562 (0.110)	0.647 (0.079)	0.783 (0.110)	0.620 (0.077)	0.819 (0.079)
Item 7	0.561 (0.118)	0.653 (0.082)	0.784 (0.110)	0.725 (0.062)	0.938 (0.037)

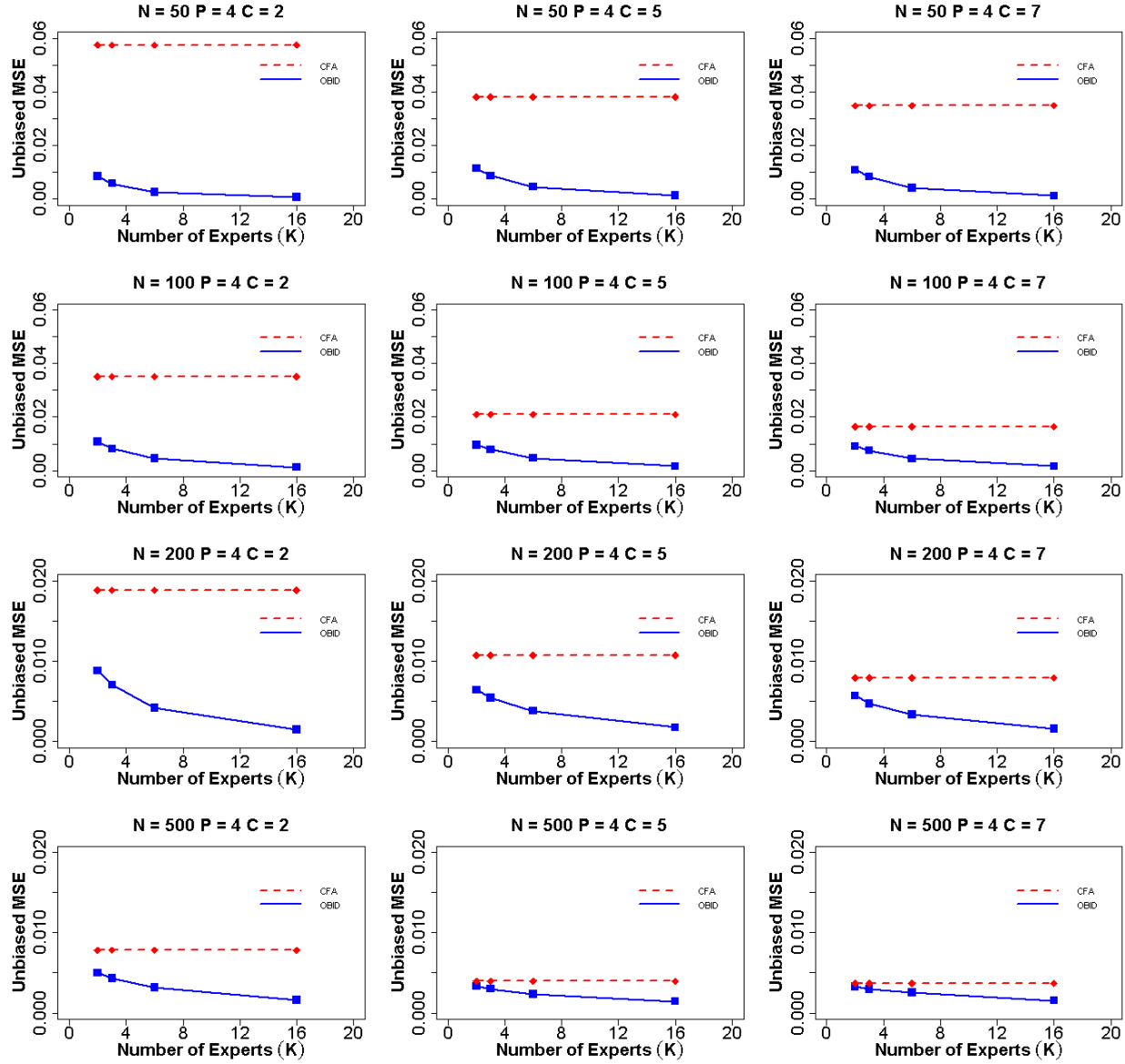


Figure 1. Average mean squared error (MSE) for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are unbiased $\{\rho_0 = (0.50, 0.30, 0.70, 0.50)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

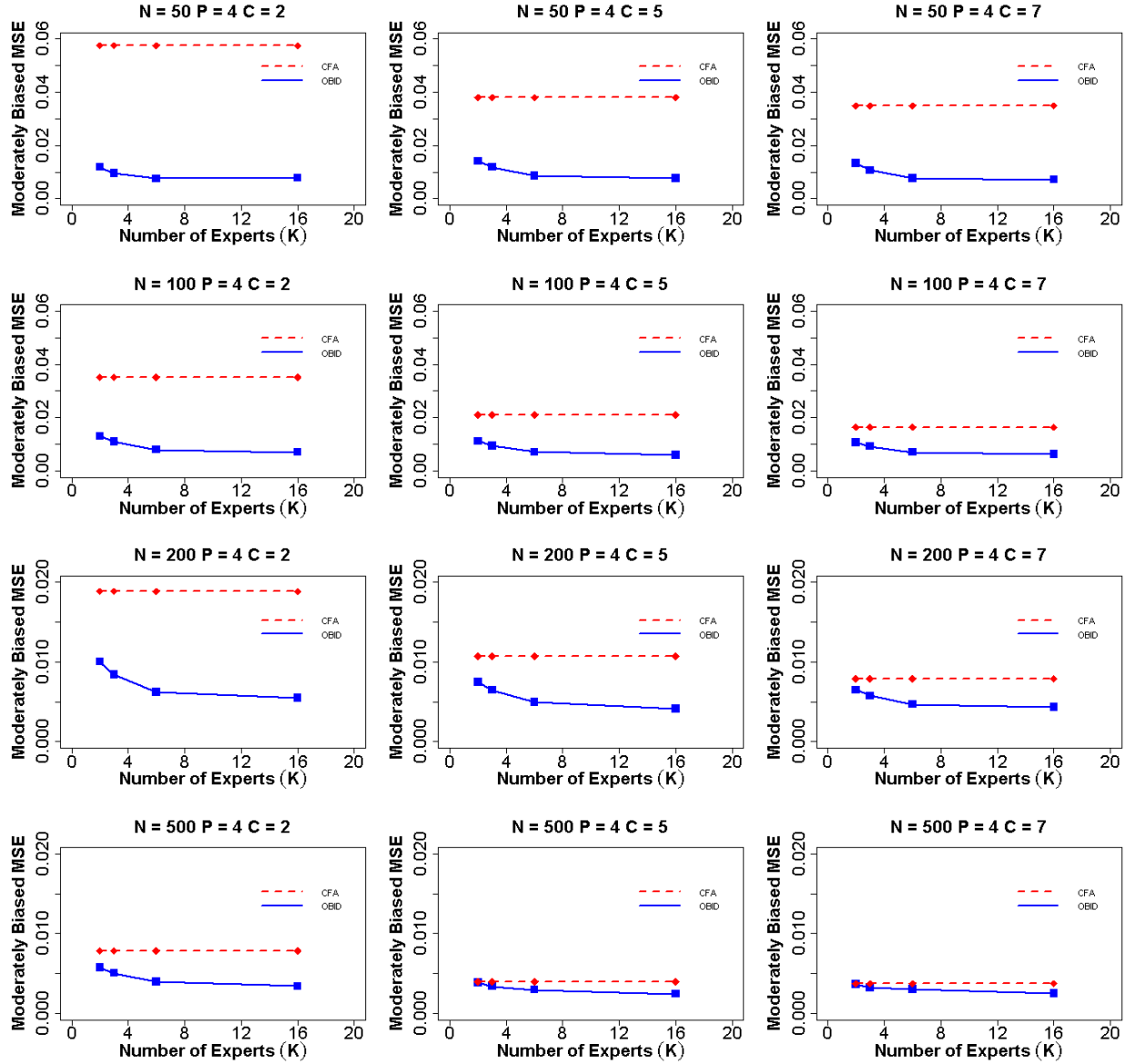


Figure 2. Average mean squared error (MSE) for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are moderately biased $\{\rho_0 = (0.60, 0.40, 0.80, 0.60)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

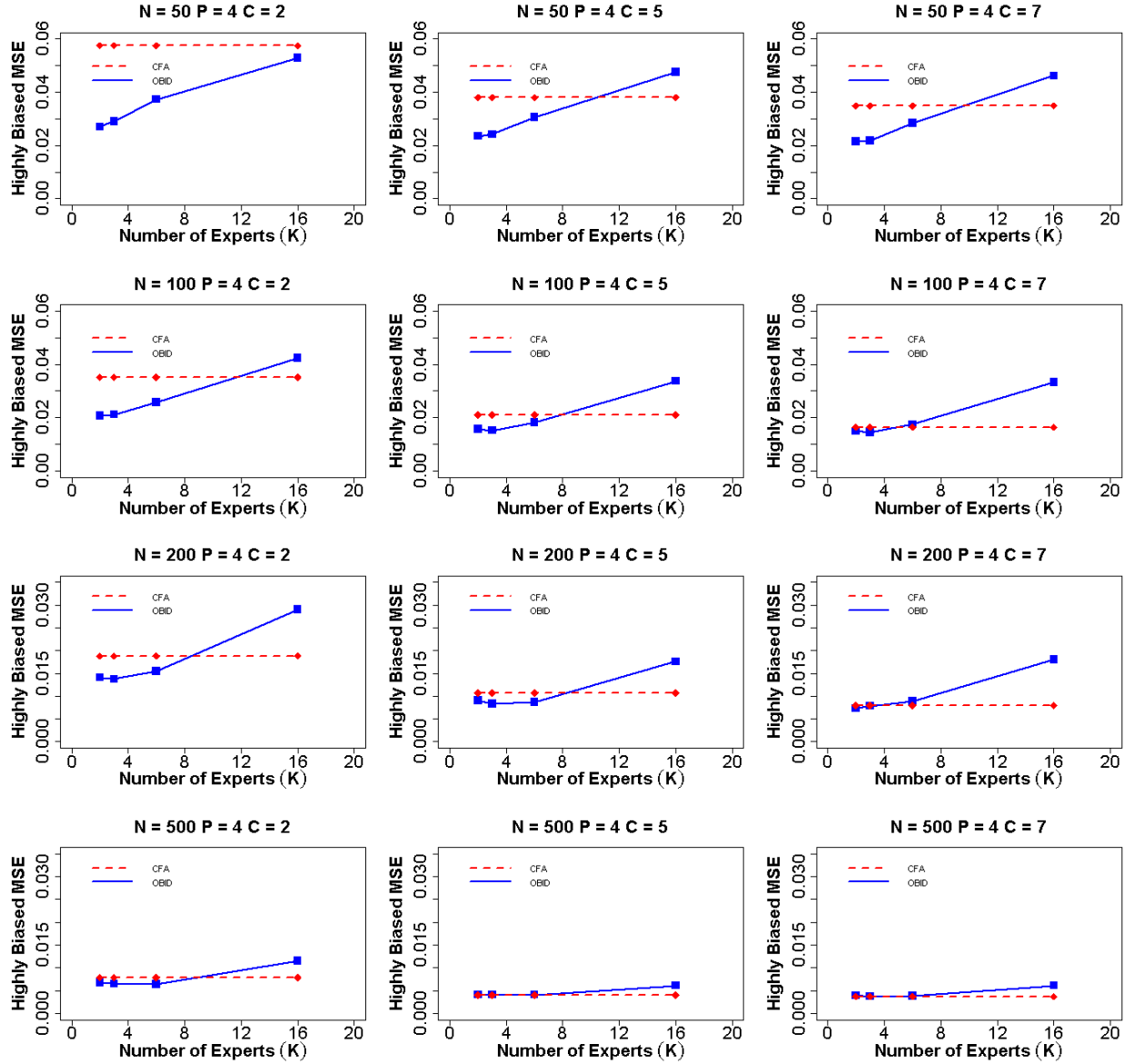


Figure 3. Average mean squared error (MSE) for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are highly biased $\{\rho_0 = (0.75, 0.65, 0.85, 0.75)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

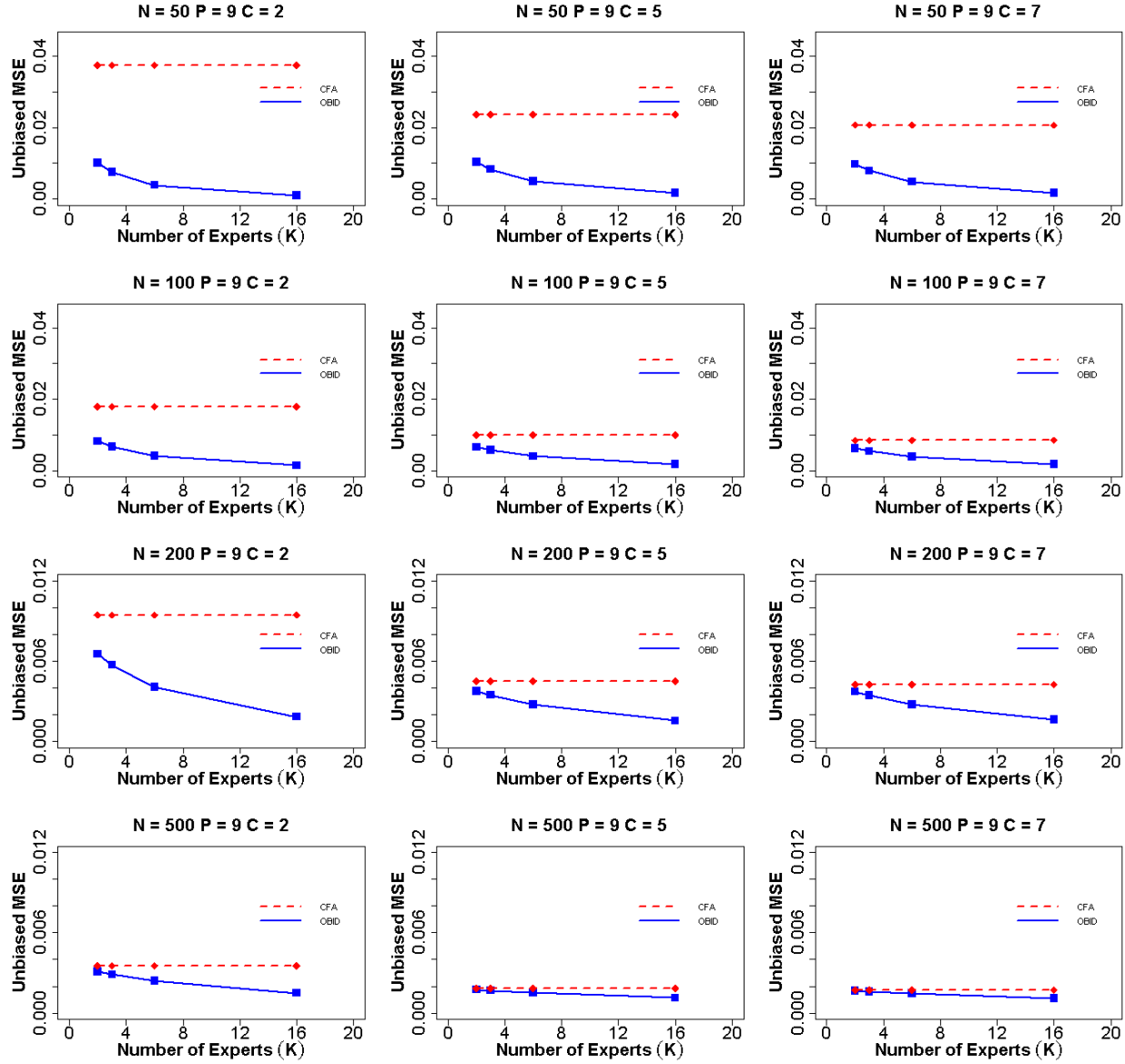


Figure 4. Average mean squared error (MSE) for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are unbiased $\{\rho_0 = (0.30, 0.50, 0.70, 0.70, 0.30, 0.50, 0.70, 0.50, 0.30)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

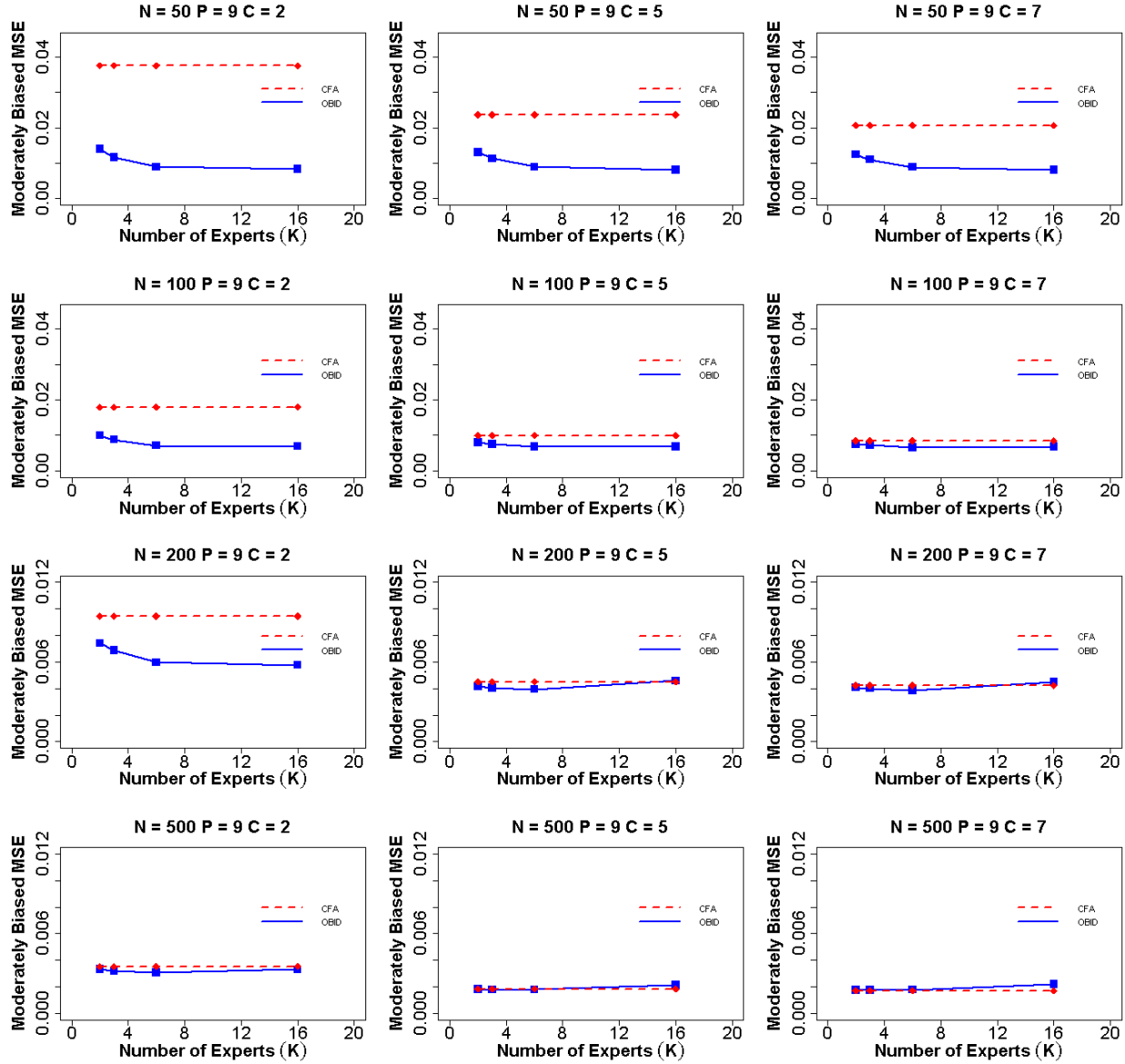


Figure 5. Average mean squared error (MSE) for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are moderately biased $\{\rho_0 = (0.40, 0.60, 0.80, 0.80, 0.40, 0.60, 0.80, 0.60, 0.40)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

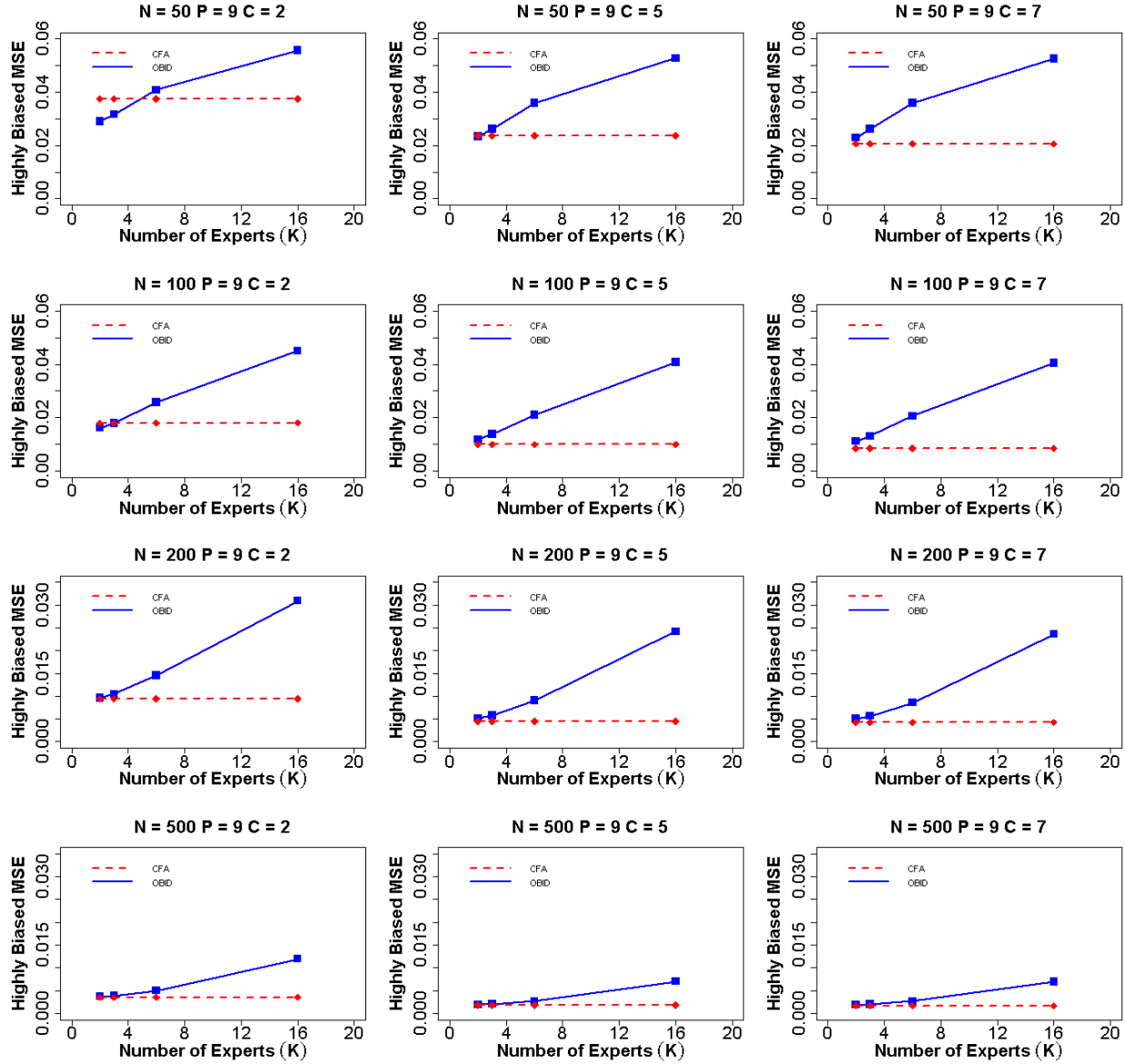


Figure 6. Average mean squared error (MSE) for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are highly biased $\{\rho_0 = (0.65, 0.75, 0.85, 0.85, 0.65, 0.75, 0.85, 0.75, 0.65)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

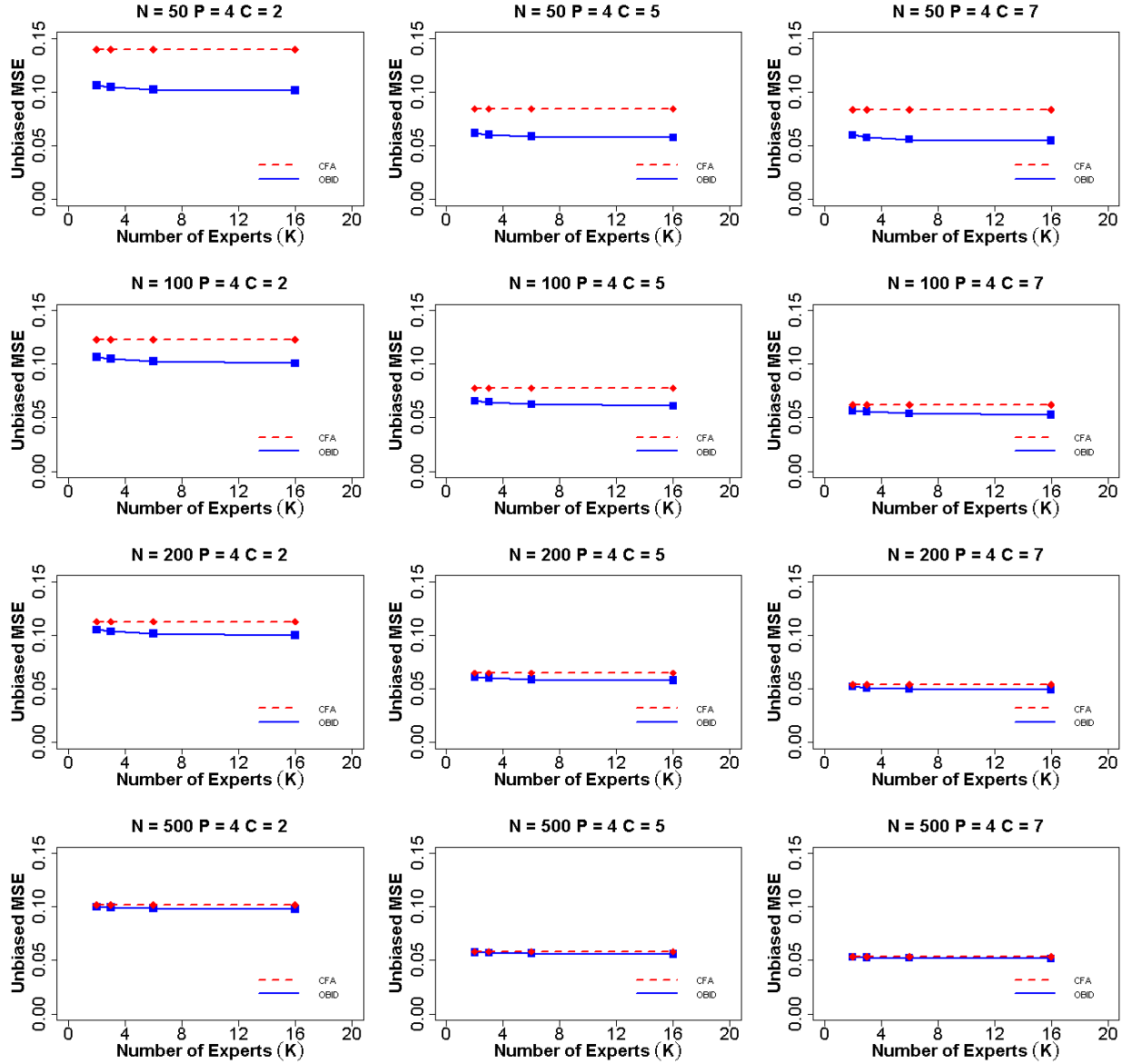


Figure 7. Mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are unbiased $\{\rho_0 = (0.50, 0.30, 0.70, 0.50)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

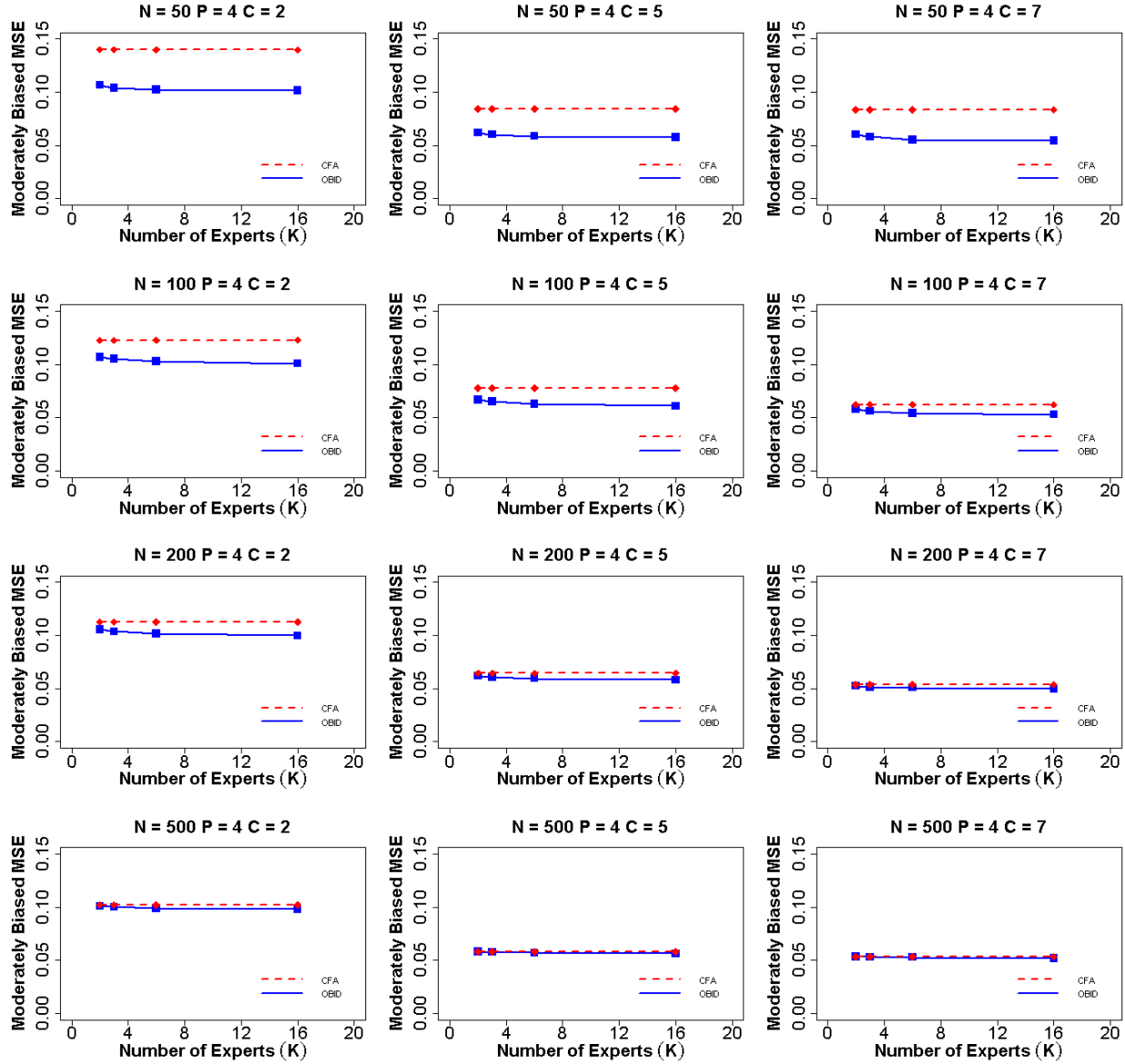


Figure 8. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are moderately biased $\{\rho_0 = (0.60, 0.40, 0.80, 0.60)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

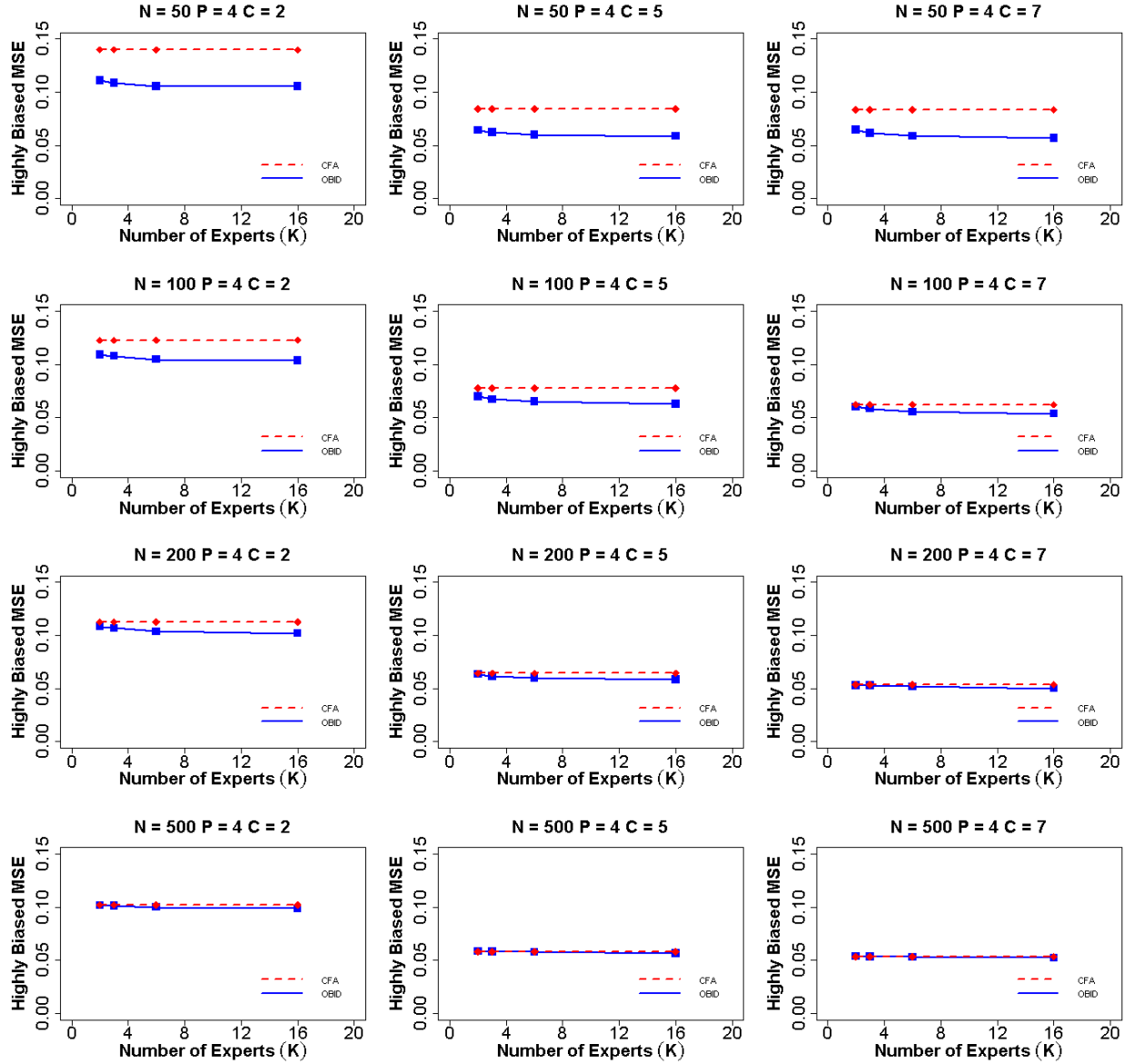


Figure 9. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are highly biased $\{\rho_0 = (0.75, 0.65, 0.85, 0.75)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

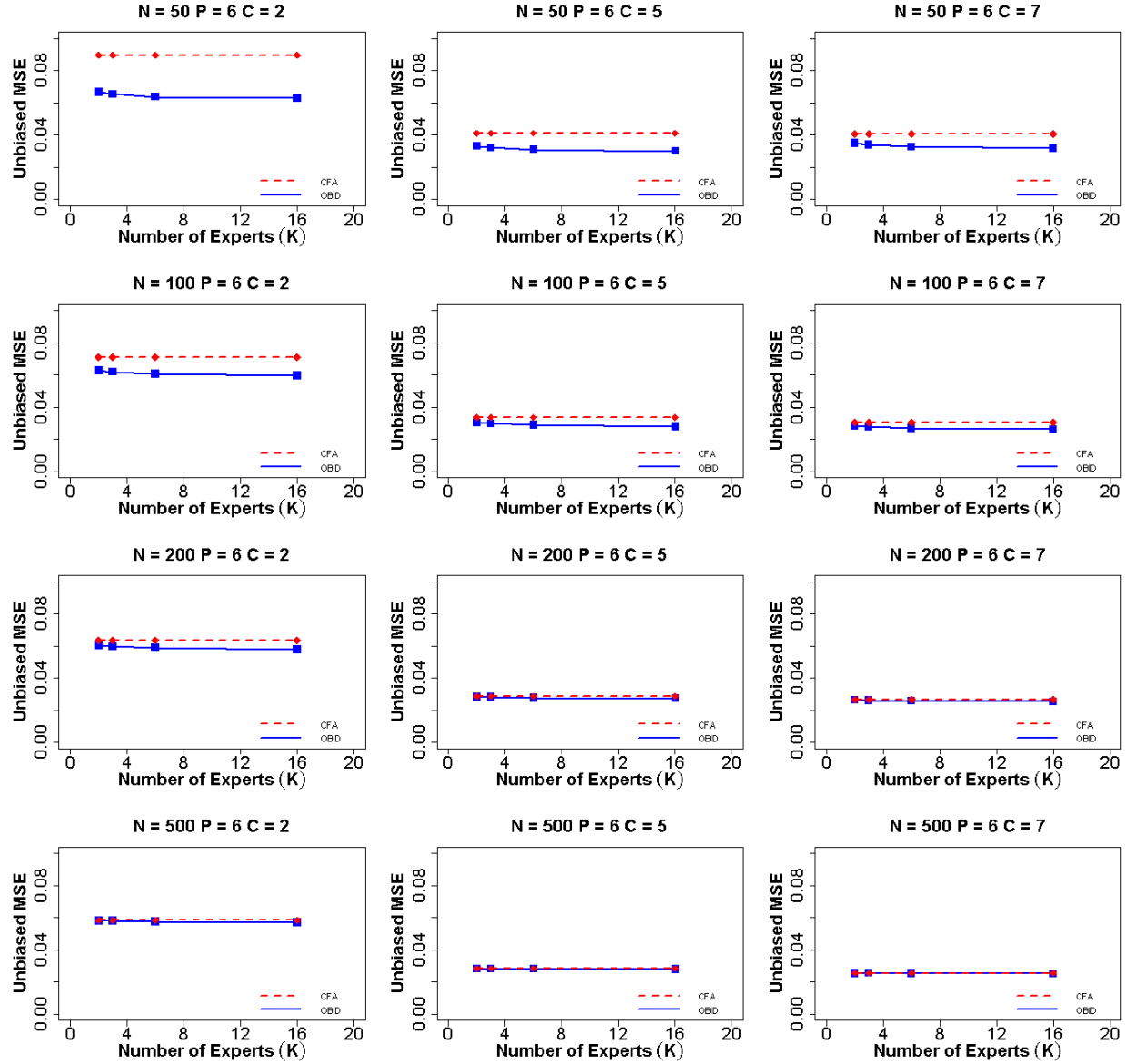


Figure 10. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 6$ (number of items) and experts are unbiased $\{\rho_0 = (0.30, 0.50, 0.70, 0.70, 0.30, 0.50)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

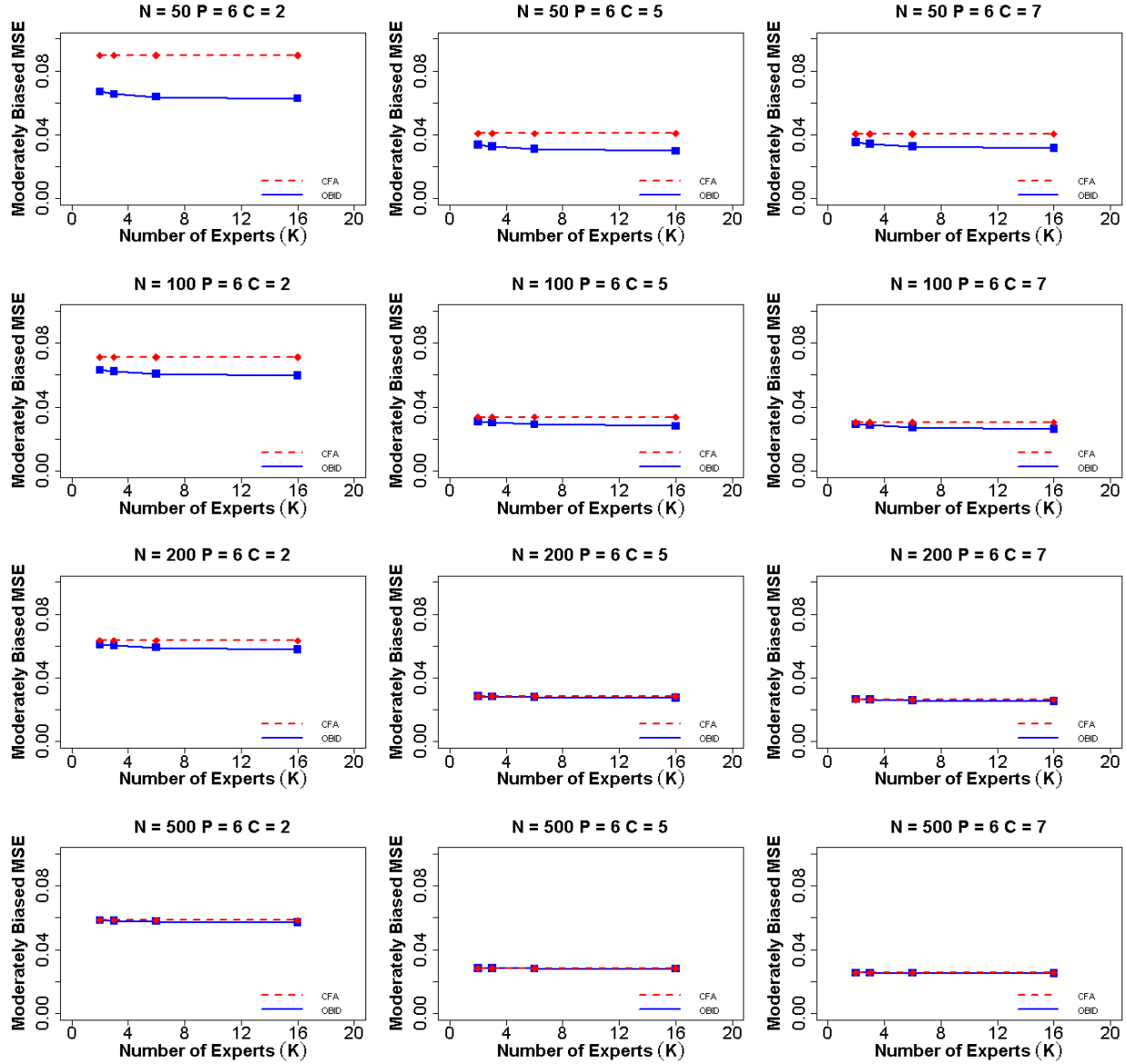


Figure 11. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 6$ (number of items) and experts are moderately biased $\{\rho_0 = (0.40, 0.60, 0.80, 0.80, 0.40, 0.60)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

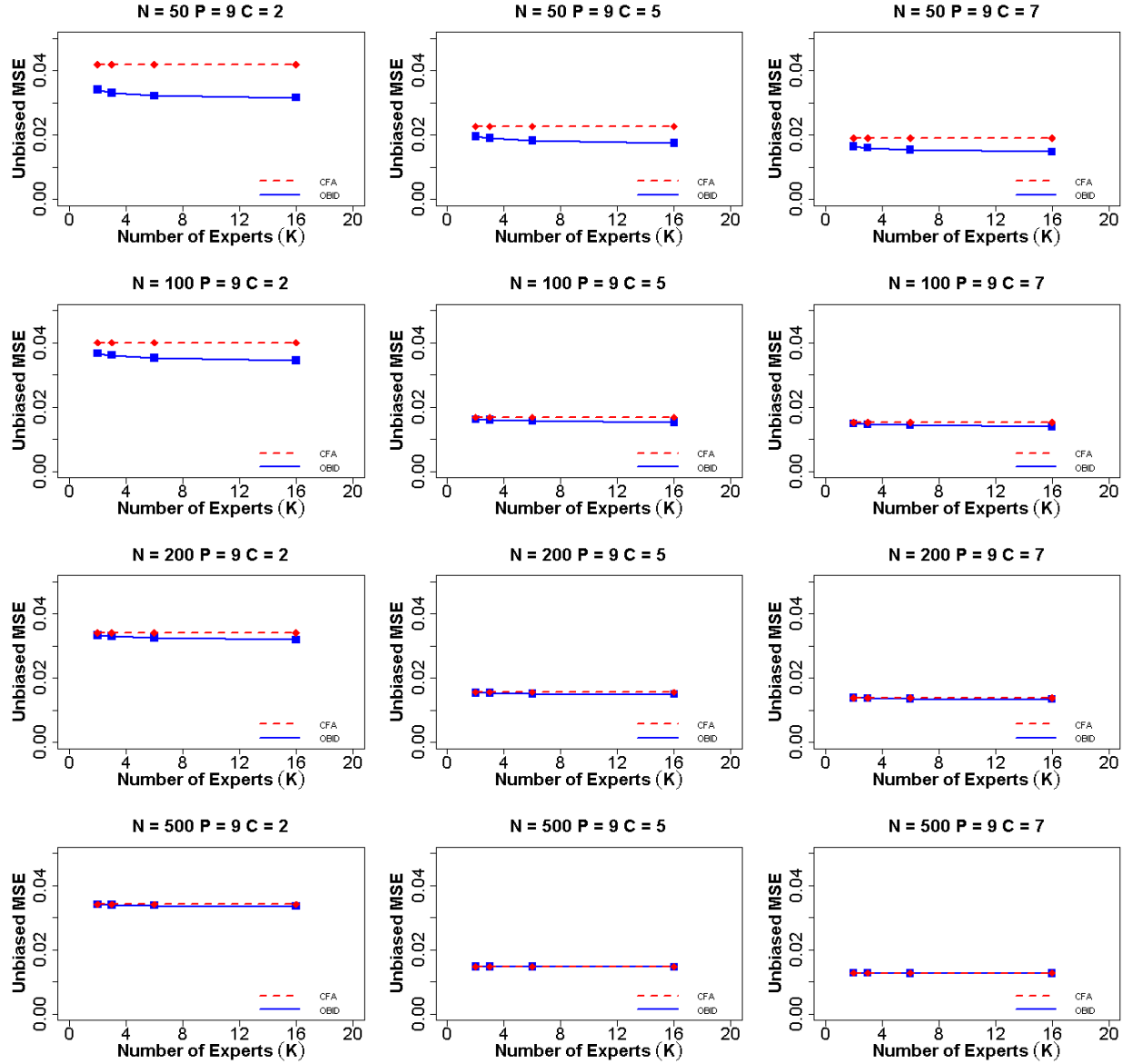


Figure 12. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are unbiased $\{\rho_0 = (0.30, 0.50, 0.70, 0.70, 0.30, 0.50, 0.70, 0.50, 0.30)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

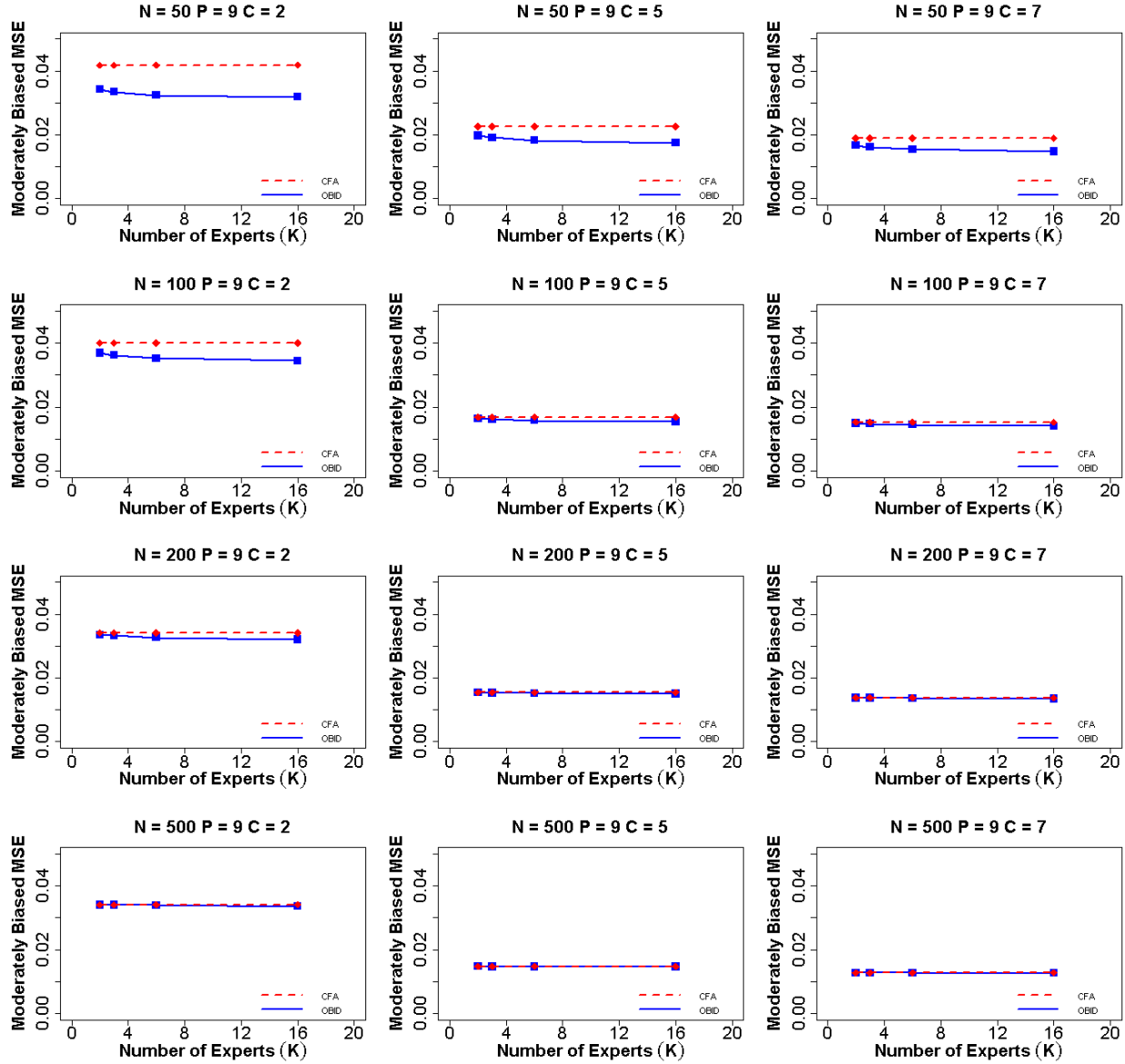


Figure 13. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are moderately biased $\{\rho_0 = (0.40, 0.60, 0.80, 0.80, 0.40, 0.60, 0.80, 0.60, 0.40)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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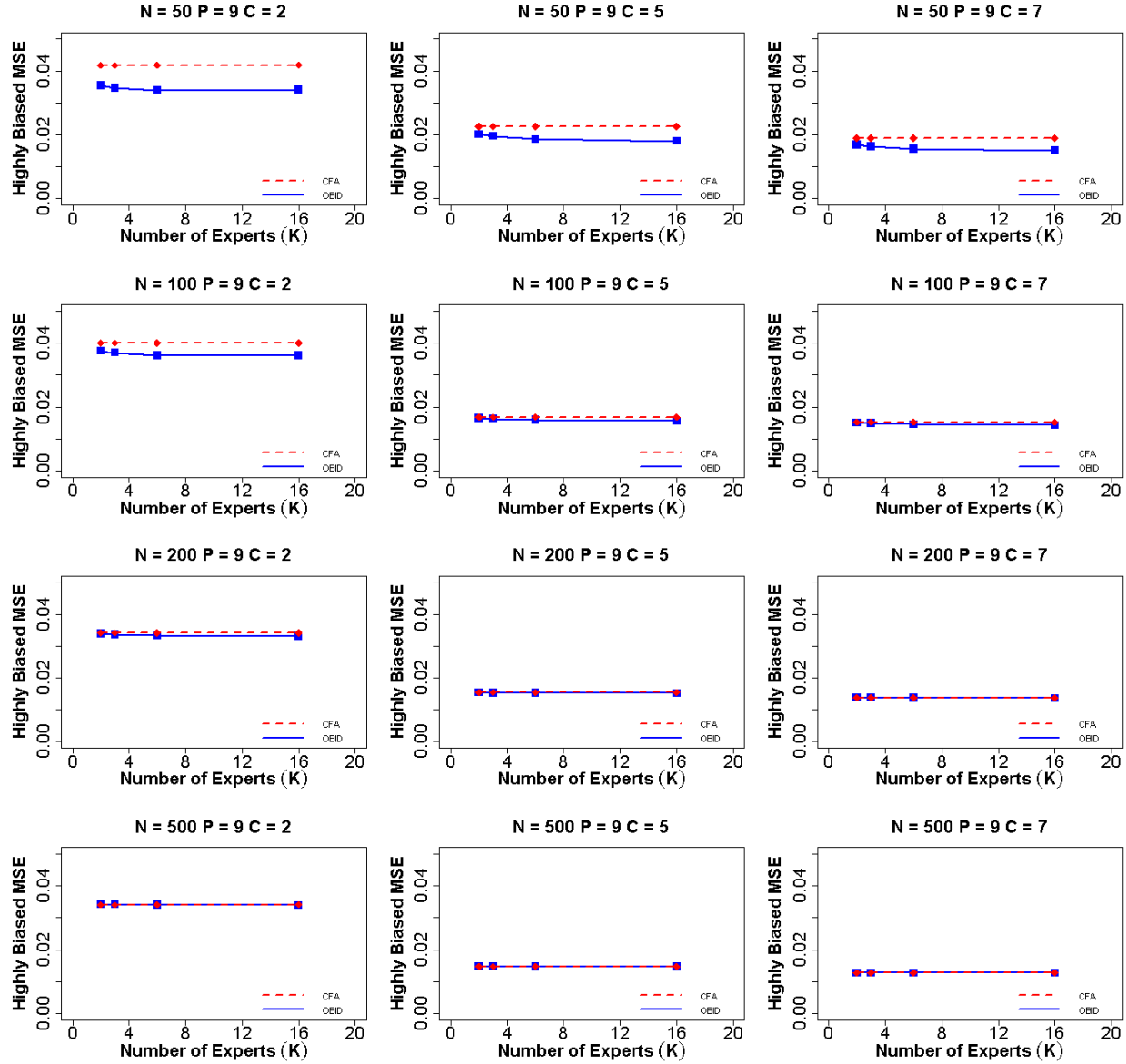


Figure 14. Average mean squared error (MSE) for validity coefficient γ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are highly biased $\{\rho_0 = (0.65, 0.75, 0.85, 0.85, 0.65, 0.75, 0.85, 0.75, 0.65)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

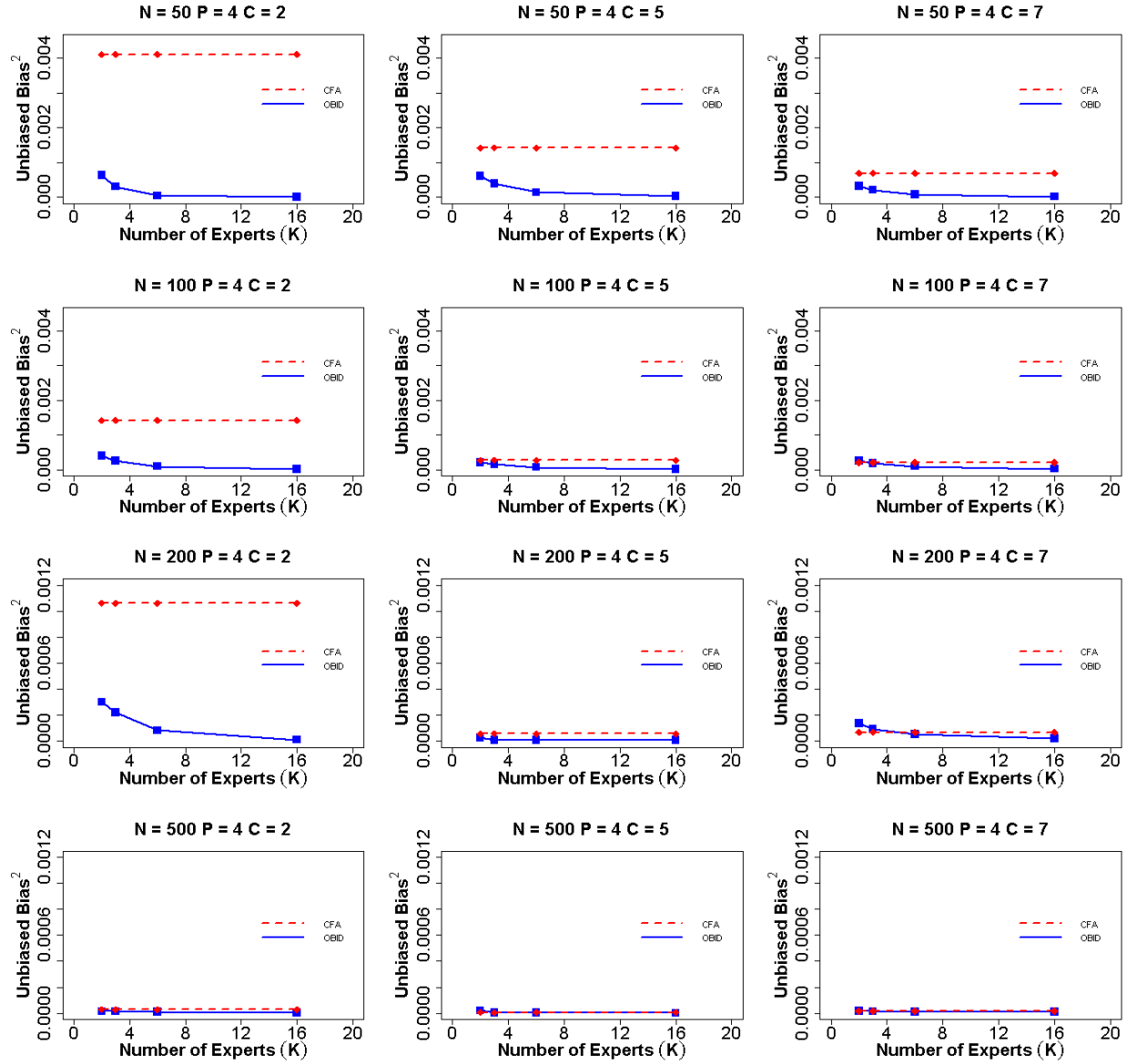


Figure 15. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are unbiased $\{\rho_0 = (0.50, 0.30, 0.70, 0.50)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

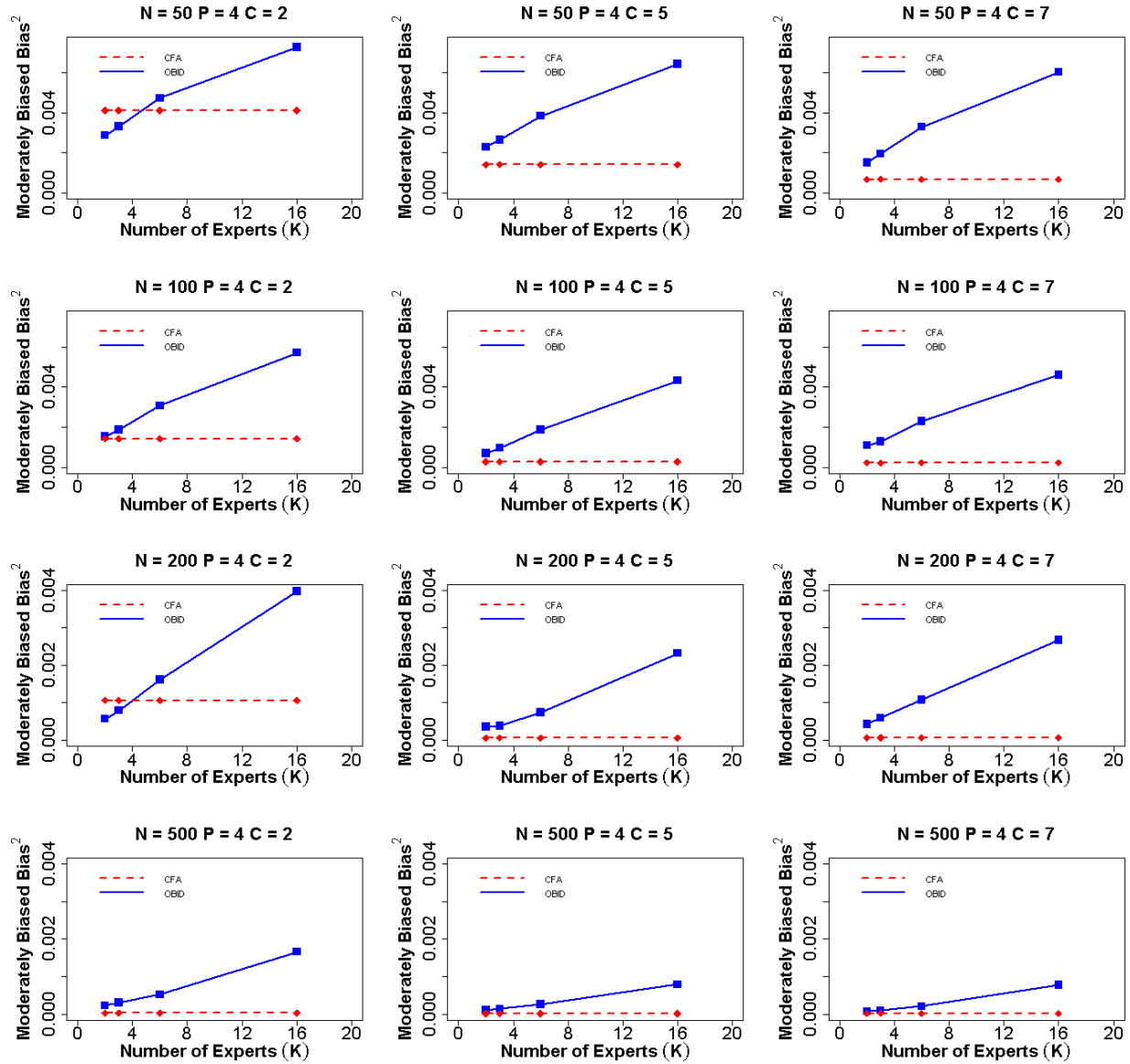


Figure 16. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are moderately biased $\{\rho_0 = (0.60, 0.40, 0.80, 0.60)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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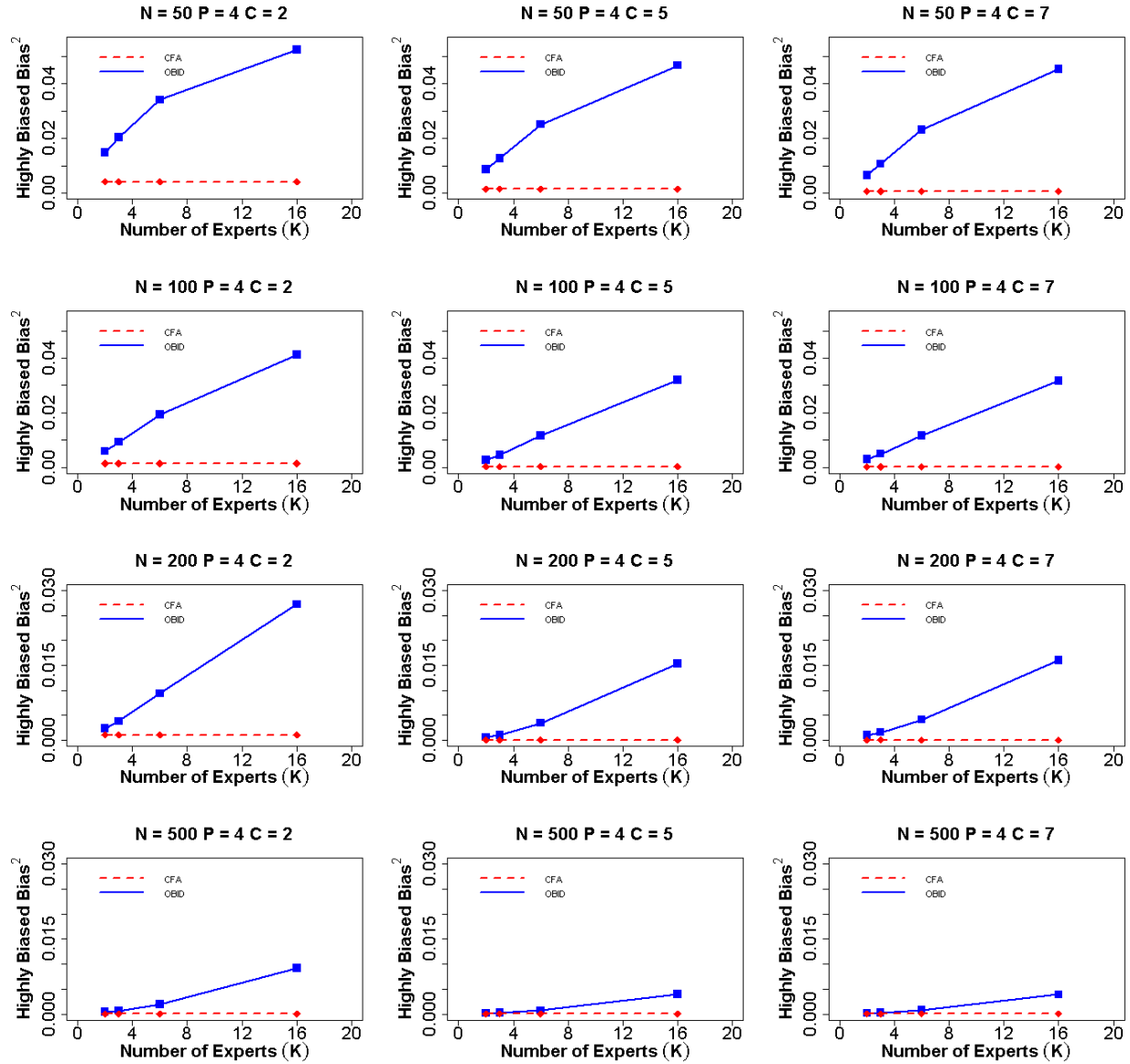


Figure 17. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 4$ (number of items) and experts are highly biased $\{\rho_0 = (0.75, 0.65, 0.85, 0.75)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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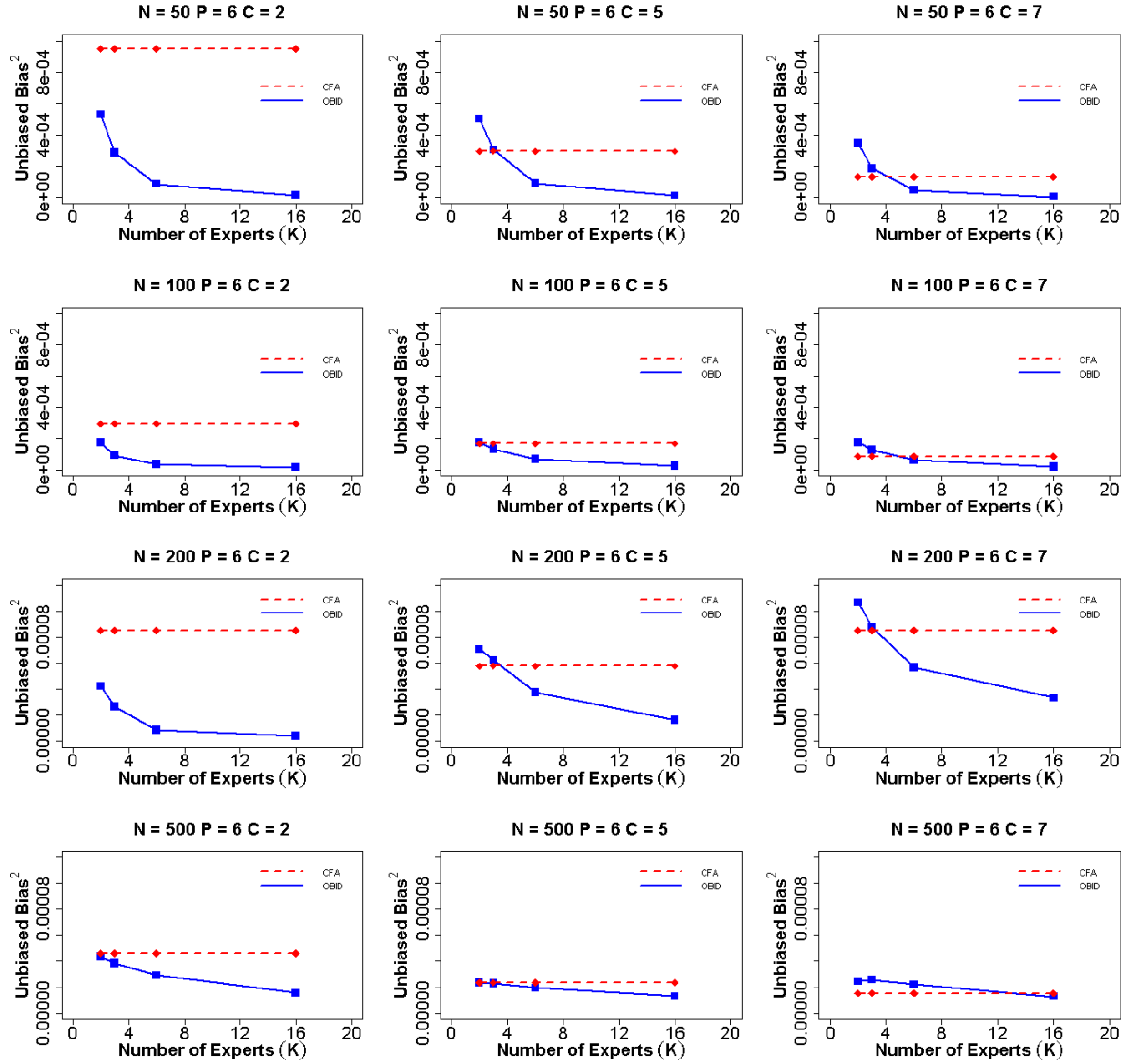


Figure 18. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 6$ (number of items) and experts are unbiased $\{\rho_0 = (0.30, 0.50, 0.70, 0.70, 0.30, 0.50)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

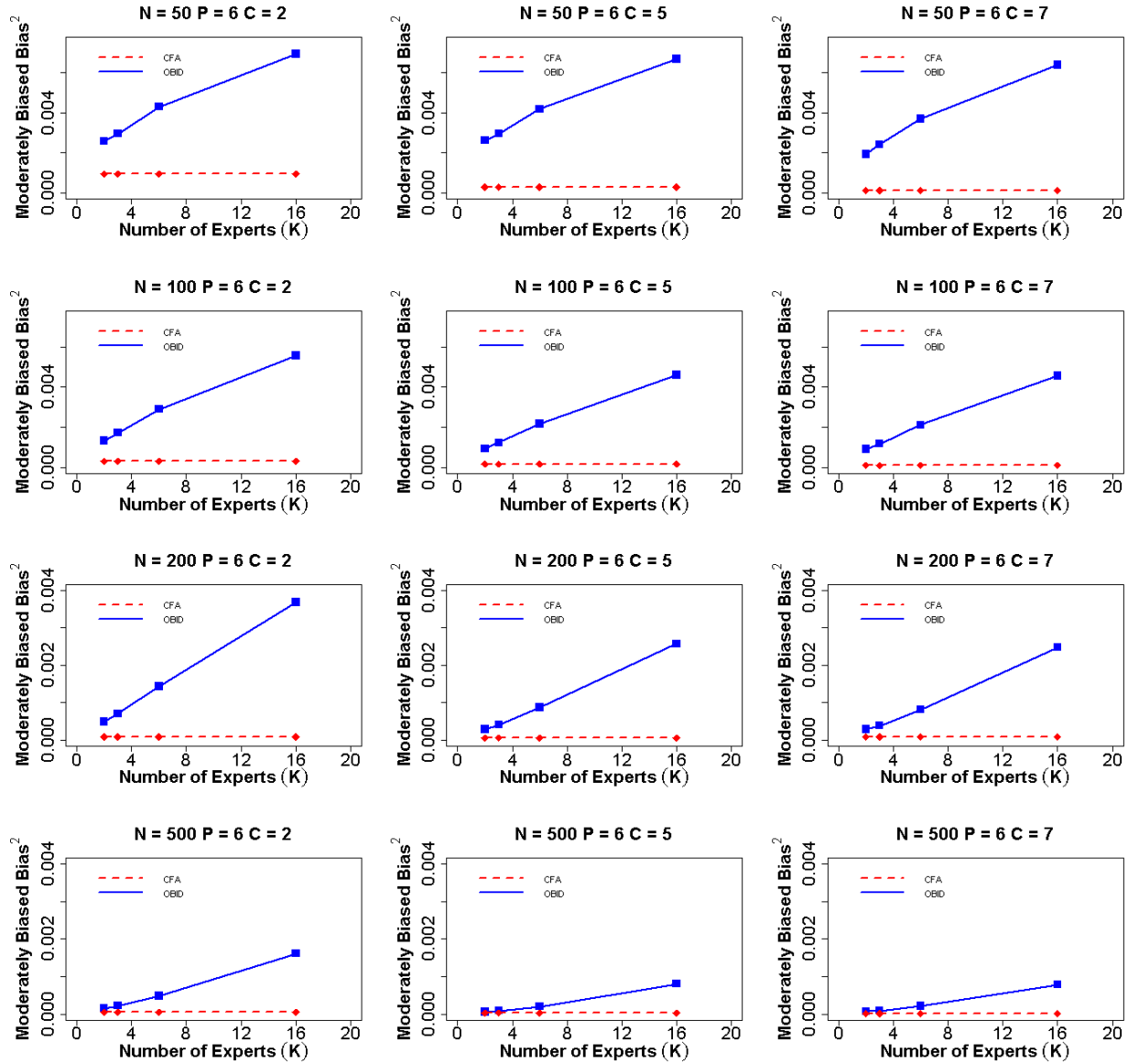


Figure 19. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 6$ (number of items) and experts are moderately biased $\{\rho_0 = (0.40, 0.60, 0.80, 0.80, 0.40, 0.60)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

Note. OBID = Ordinal Bayesian Instrument Development; CFA = Confirmatory Factor Analysis.

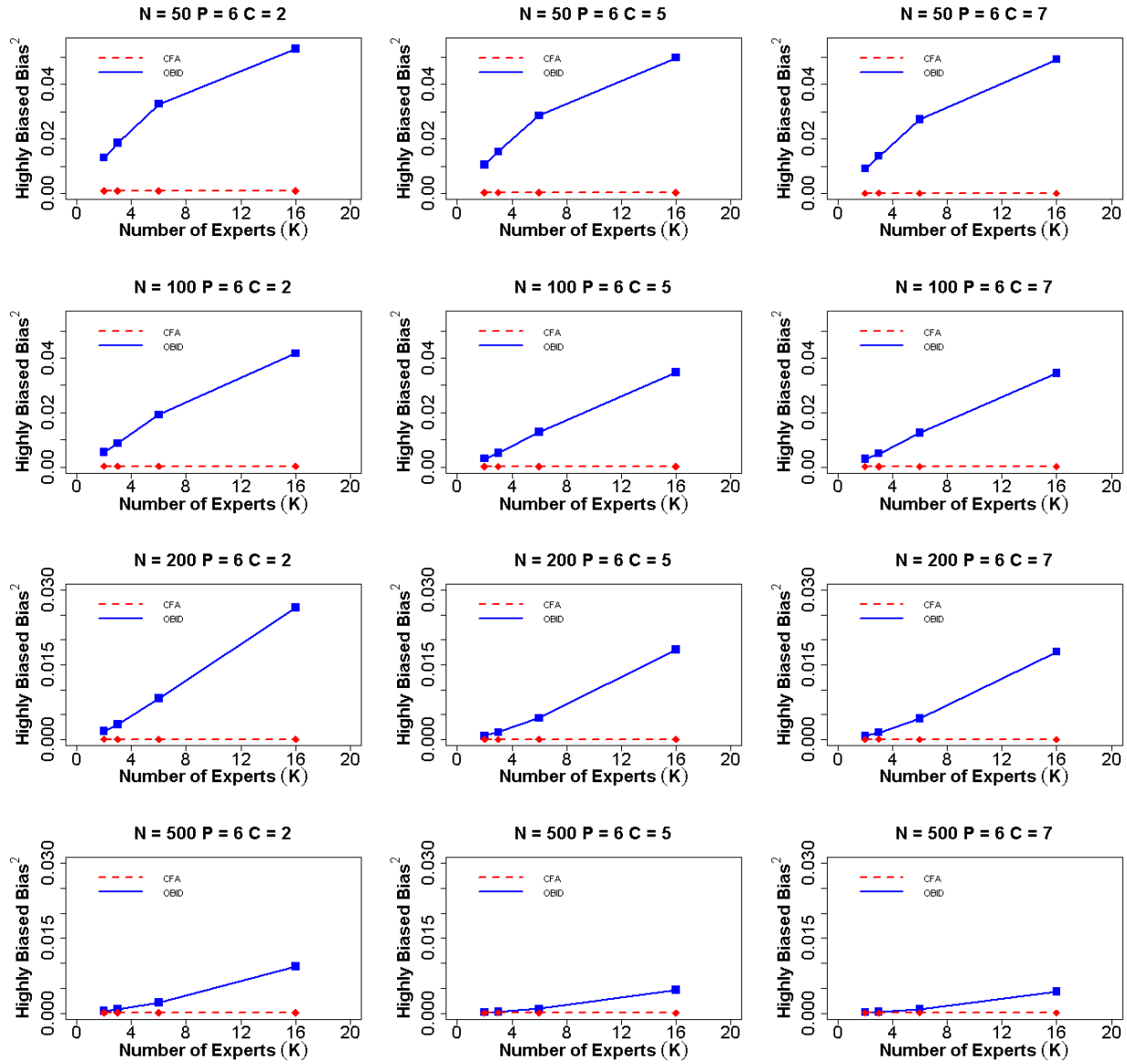


Figure 20. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 6$ (number of items) and experts are highly biased $\{\rho_0 = (0.65, 0.75, 0.85, 0.85, 0.65, 0.75)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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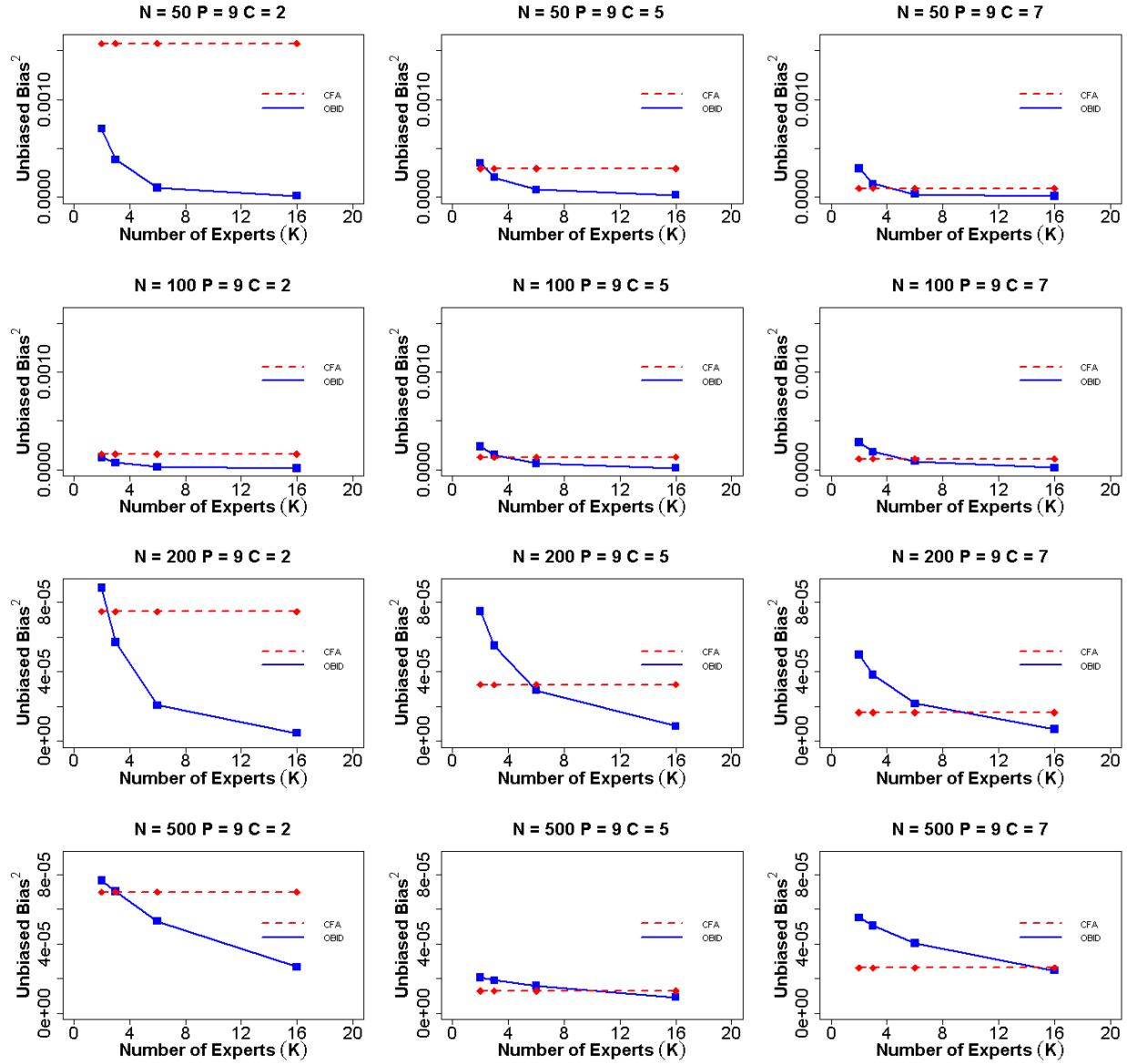


Figure 21. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are unbiased $\{\rho_0 = (0.30, 0.50, 0.70, 0.70, 0.30, 0.50, 0.70, 0.50, 0.30)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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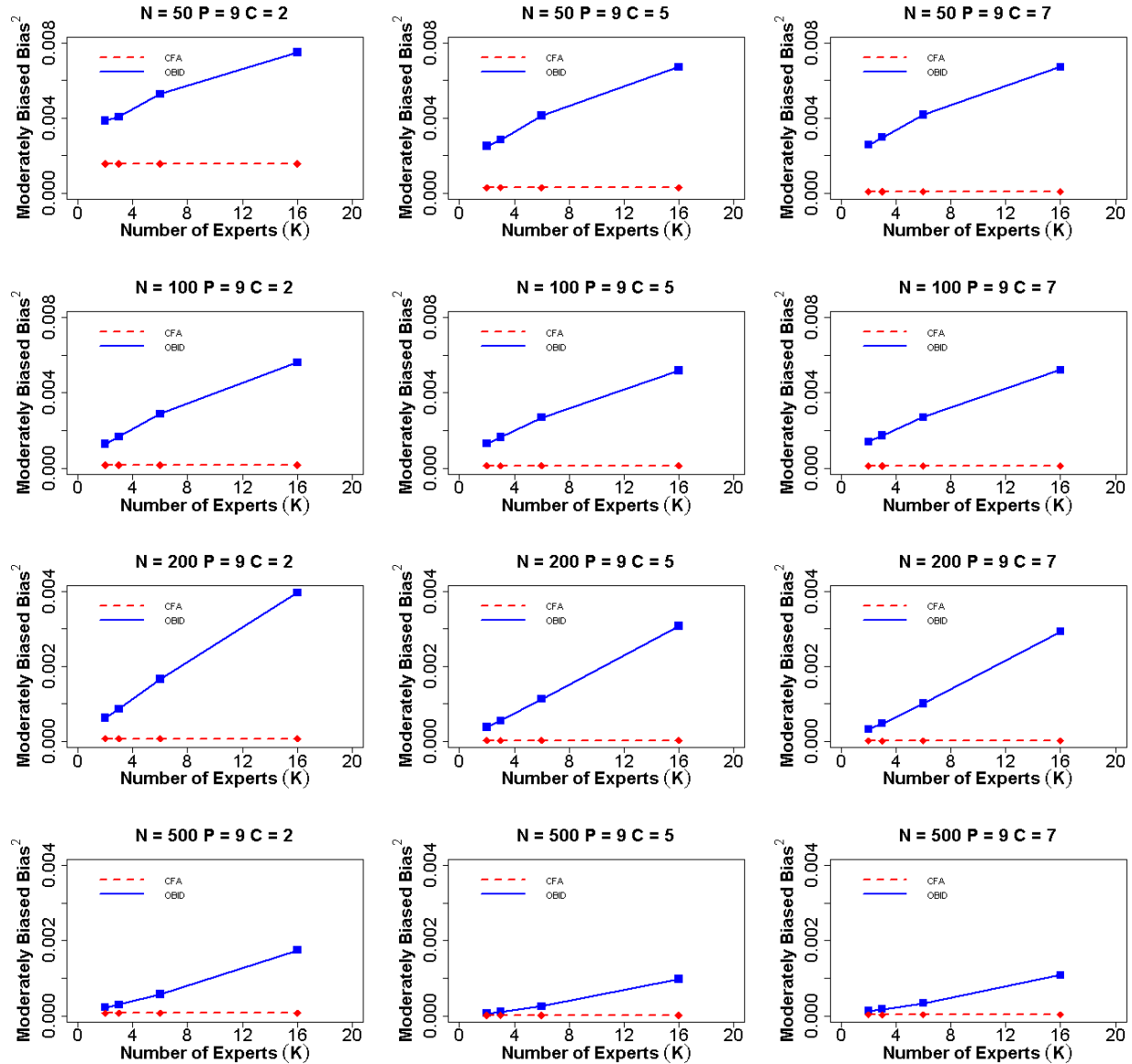


Figure 22. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are moderately biased $\{\rho_0 = (0.40, 0.60, 0.80, 0.80, 0.40, 0.60, 0.80, 0.60, 0.40)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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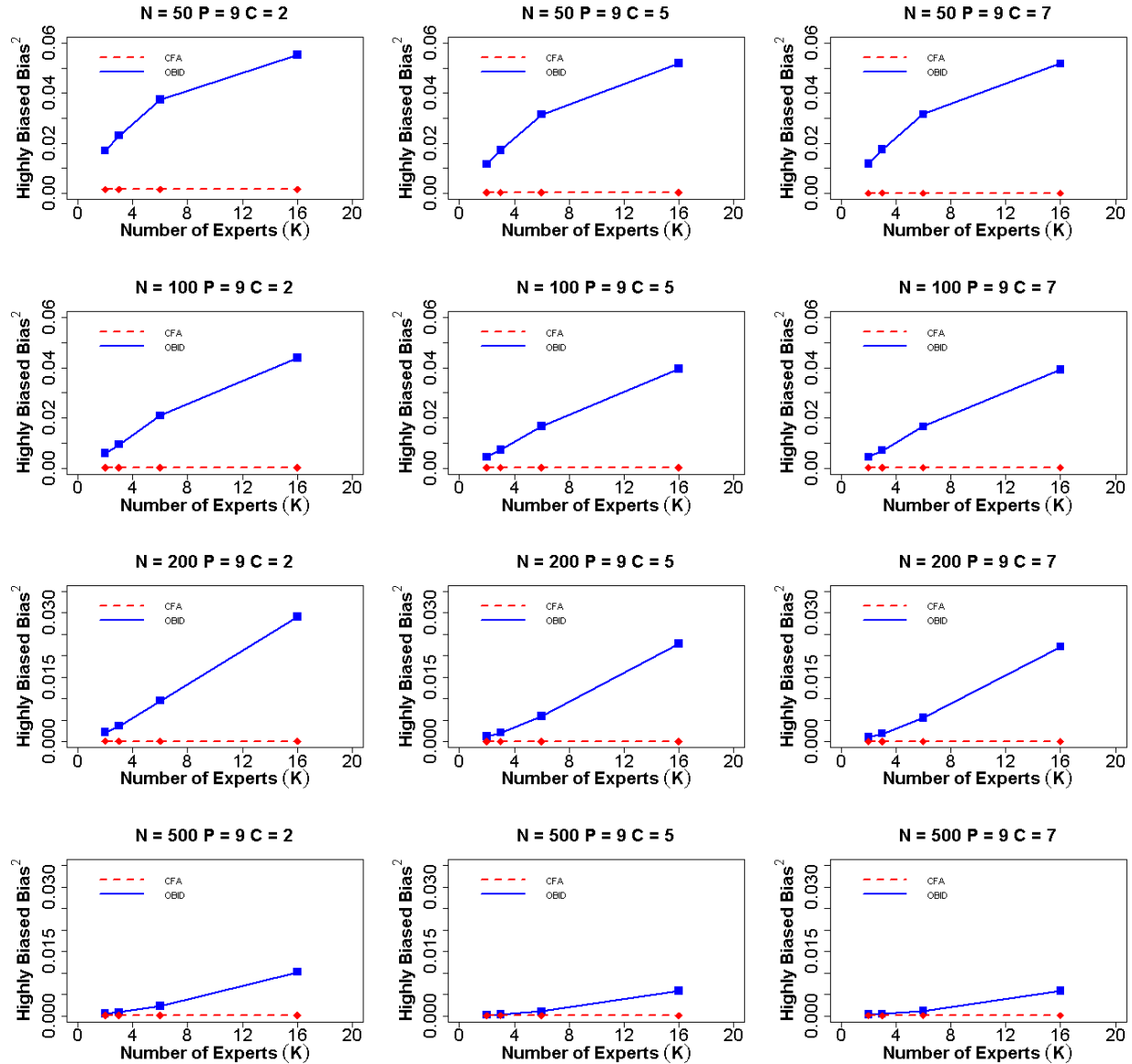


Figure 23. Average squared bias for item-to-domain correlation ρ using OBID (solid blue line) and ordinal CFA (dashed red line) when $P = 9$ (number of items) and experts are highly biased $\{\rho_0 = (0.65, 0.75, 0.85, 0.85, 0.65, 0.75, 0.85, 0.75, 0.65)\}$. The participant sample sizes are $N = 50, 100, 200$, and 500 . The numbers of response categories are $C = 2, 5$, and 7 , and the numbers of experts are $K = 2, 3, 6$, and 16 .

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